any other elements of the user interface system **100**. The displacement device **130**, in this version, may be located within or adjacent to the cavity **125**. In another version, the cavity **125** includes a fluidic connection via a channel to a (remotely located) displacement device **130**. In both cases, the cavity **125** can be considered an "enclosed cavity" since the cavity **125** is preferably fluid tight (except for any fluidic connections to the displacement device **130**). When used with a mobile phone device, the cavity **125** preferably has a diameter of 2-10 mm. When used with this or other applications, however, the cavity **125** may have any suitable dimension.

2. The Displacement Device

[0032] The displacement device **130** of the preferred embodiment functions to modify the volume of the fluid thereby expanding the cavity **125** from the retracted volume setting to the extended volume setting and, ultimately, deforming a particular region of the surface **115**. The displacement device **130** preferably modifies the volume of the fluid by (1) modifying the volume of the existing fluid in the cavity **125**, or (2) adding and removing fluid to and from the cavity **125**. The displacement device **130** may, however, modify the volume of the fluid by any suitable device or method. Modifying the volume of the existing fluid in the cavity **125** most likely has an advantage of lesser complexity, while adding and removing fluid to and from the cavity **125** most likely has an advantage of maintaining the deformation of the surface **115** without the need for additional energy (if valves or other lockable mechanisms are used). When used with a mobile phone device, the displacement device **130** preferably increases the volume of the fluid within the cavity **125** by approximately 0.003-0.1 ml. When used with this or other applications, however, the volume of the fluid may be increased (or possibly decreased) by any suitable amount.

[0033] Modifying the existing fluid in the cavity **125** may be accomplished in several ways. In a first example, as shown in FIGS. **7***a* and **7***b*, the fluid may be an expandable fluid and the displacement device **130** may include a heating element that heats the expandable fluid, thereby expanding the volume of the existing fluid in the cavity **125** (according to the ideal gas law, PV=nRT). The heating element, which may be located within or adjacent the cavity **125**, is preferably a resistive heater (made of a material such as TaN or Nichrome). In a second example, the fluid may include an expandable substance, such as plastic expandable microspheres. In a third example, the fluid may include paraffin. While these are three examples, the displacement device **130** can be any other suitable device or method that ultimately expands the cavity **125** from the retracted volume setting to the extended volume setting by modifying the existing fluid in the cavity **125**.

[0034] Adding and removing fluid to and from the cavity **125** may also be accomplished in several ways. In a first example, as shown in FIG. **8**, the displacement device **130** includes a reservoir **132** to hold additional fluid and a pump **134** to displace fluid from the reservoir **132** to the cavity **125**. The reservoir **132** is preferably remote from the cavity **125** (and connected by a channel **138** or other suitable device), but may alternatively be located adjacent the cavity **125** and connected directly to the cavity **125**. A portion of the channel **138** is preferably a micro-fluidic channel (having cross-section dimensions in the range of 1 micrometer to 1000 micrometers), but depending on the size and costs constraints of the user interface system **100**, the channel **138** may have any suitable dimensions. The pump **134** is preferably a micropump (such as pump #MDP2205 from ThinXXs Microtechnology AG of Zweibrucken, Germany or pump #mp5 from Bartels Mikrotechnik GmbH of Dortmund, Germany), but may be any suitable device to pump fluid from one location to another. The pump **134** is preferably located at a distance from the cavity **125**, and is preferably connected to the cavity **125** by a channel **138**. To extend the cavity **125** from a retracted volume setting to the extended volume setting, the pump **134** displaces fluid from a reservoir **132**, through the channel **138**, and into the cavity **125**. To retract the cavity **125** from the extended volume setting to the retracted volume setting, the pump **134** preferably "vents" or pumps in a reverse direction from the cavity **125** to the reservoir **132**. In a second example, as shown in FIG. **9**, the displacement device **130** includes a reservoir **132** to hold additional fluid, a first pump **134** to displace fluid from the reservoir **132** to the cavity **125**, a second pump **136** to displace fluid from the cavity **125** to the reservoir **132**, a first valve located between the first pump **134** and the cavity **125**, and a second valve located between the cavity **125** and the second pump **136**. To extend the cavity **125** from the retracted volume setting to the extended volume setting, the first valve is opened, the second valve is closed, and the first pump **134** displaces fluid from the reservoir **132**, through the channel **138**, and into the cavity **125**. To retract the cavity **125** from the extended position to the retracted position, the first valve is closed, the second valve is opened, and the second pump **136** displaces fluid from the cavity **125**, through the channel **138**, and into the reservoir **132**. In other respects, the second example is similar to the first example above. The user interface system **100** may omit the second pump **136** and simply retract the cavity **125** from the extended volume setting to the retracted volume setting by opening the second valve and allowing the cavity **125** to vent or "drain" into the reservoir **132** (potentially assisted by the elasticity of the layer **110** returning to an un-deformed state). In a third example, as shown in FIGS. **10***a* and **10***b*, the displacement device **130** includes an actuator, such as a linear actuator, that displaces fluid into and out of the cavity **125**. To extend the cavity **125** from a retracted volume setting to the extended volume setting, as shown in FIG. **10***a*, the linear actuator displaces fluid through the channel **138** and into the cavity **125**. To retract the cavity **125** from the extended volume setting to the retracted volume setting, as shown in FIG. **10***b*, the linear actuator draws fluid in a reverse direction from the cavity **125** to the reservoir **132**. In other respects, the third example is similar to the second example above. While these are three examples, the displacement device **130** can be any other suitable device or method that ultimately expands the cavity **125** from the retracted volume setting to the extended volume setting by adding and removing fluid to and from the cavity **125**.

[0035] Although the cause of the deformation of a particular region of the surface **115** has been described as a modification of the volume of the fluid in the cavity **125**, it is possible to describe the cause of the deformation as an increase in the pressure below the surface **115** relative to the pressure above the surface **115**. When used with a mobile phone device, an increase of approximately 0.1-10.0 psi between the pressure below the layer **110** relative to the pressure above the layer **110**, is preferably enough to deform a particular region of the surface **115**. When used with this or other applications, however, the modification of the pressure may be increased (or possibly decreased) by any suitable amount.